I-29

I-49

HITACHI

HITACHI SOLID STATE TELEVISION RECEIVER

9-inch picture measured diagonally

MODELS I-29 I-49

SERVICE MANUAL

(SS chassis)

No. 135 July 1972

MASTER COPY

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SPECIFICATIONS

FREQUENCY RANGE
- VHF channels ..... 2-13 ch.
- UHF channels ..... 14-83 ch.

INTERMEDIATE FREQUENCY
- Picture I.F. carrier ..... 45.75 MHz
- Sound I.F. carrier ..... 41.25 MHz

POWER INPUT ..... AC 120V 60Hz
DC 12V Battery, Car Battery

POWER RATING ..... AC 25W
DC 12W

AUDIO POWER OUTPUT 0.5W

VIDEO RESPONSE ..... 3.0 MHz

SWEEP DEFLECTION ..... Magnetic

FOCUS ..... Electrostatic

ANTENNA INPUT IMPEDANCE ..... VHF 300 Ω balanced
UHF 300 Ω balanced

PICTURE TUBE 9AGP4

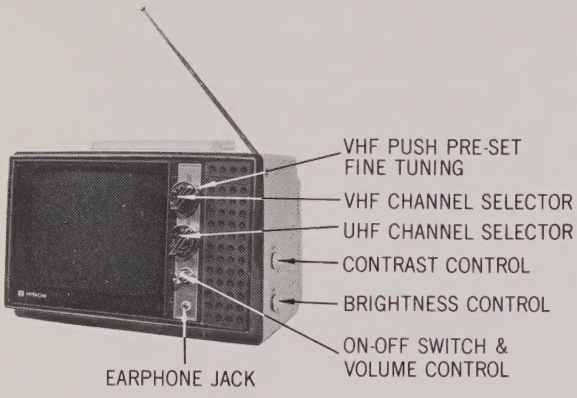
TRANSISTORS 28

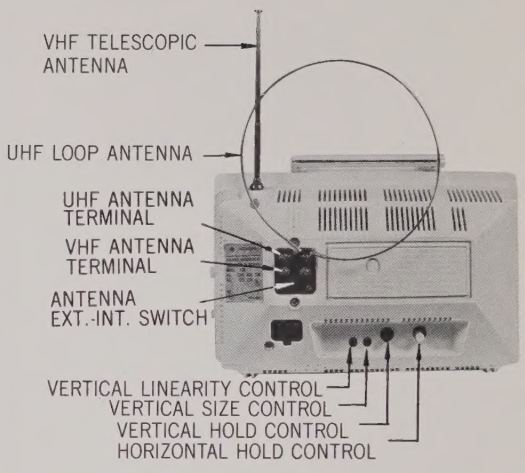
DIODES 23

CABINET DIMENSIONS .....
12-15/16"(W)× 9-1/8"(H)× 9-13/16"(D)...(I-29)
9-7/16"(W)× 11"(H)× 9-5/8"(D)...(I-49)

WEIGHT ..... 11.5 lbs....(I-29)
12.1 lbs...(I-49)

CONTROLS





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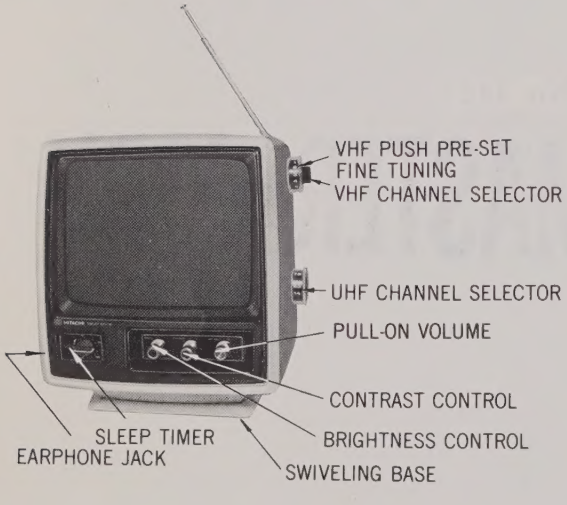

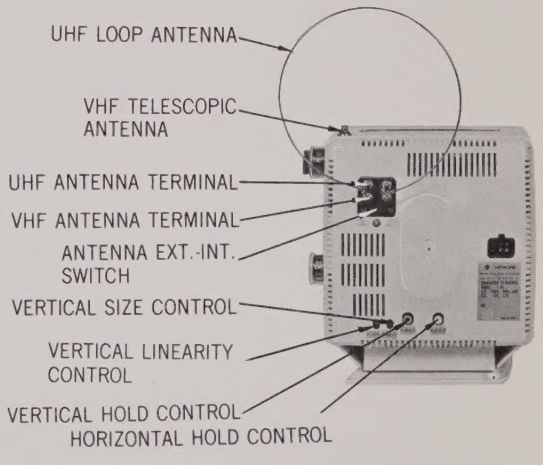

I-49

SLEEP TIMER (Only I-49)

TO "FALL ASLEEP WATCHING TV"

1. Tune in channel. Then turn SLEEP TIMER to the desired time.
2. Push the PULL-ON VOLUME CONTROL to switch your set "OFF". TV will continue to work for period of time set by SLEEP TIMER then automatically turn off.
   In case of setting the sleep timer within 15 minutes, first rotate the sleep timer more than 15 minutes in advance, and then restore it counterclockwise until the indicator of the timer comes to your desired time.

INTRODUCTION OF NEW PRODUCTS

1. NEWLY ADOPTED TRANSISTORS

The Hitachi 2SC 1162WT (NPN Transistor) and 2SA 715WT (PNP Transistor) are silicon triple-diffusion type transistors, expressly designed for complementary OTL circuits. Extremely miniaturized thanks to their resin-mold type exteriors, they can be easily fitted to base plates (used with vertical output circuits).

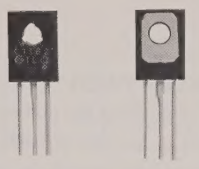

Figure 1 2SC1162WT

2. FLYBACK TRANSFORMER

This is a high-tension, open-type flyback transformer made of noncombustible material. An adequate allowance for temperatures in the high-tension section permits highly dependable designing of this product.

Compared with conventional transformers, this smaller-scaled flyback transformer greatly contributes to reduced weight of the base plate. Certain other innovative techniques are employed, such as fitting horizontal output transistors to the transformer. In the primary circuit, +B voltage is equivalently raised by approximately 25% with a boost-up strap, supplying the required DC high tension to the picture tube anode. Also a dependable DC rectifying system (conventional) is used in its high-tension rectifier system.

Since this is a high-tension, open-type flyback transformer, care must be exercised to avoid touching the high-tension section while servicing.

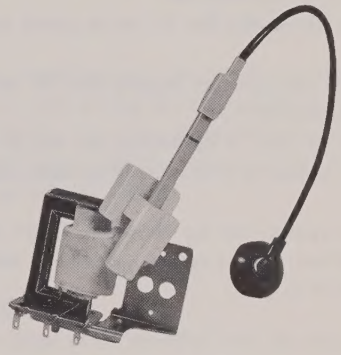

Figure 2 FLYBACK TRANSFORMER

3. DEFLECTION YOKE AND SIZE COIL

A size coil combined with a deflection yoke has been newly adopted, having considered adopting a homopolar leaf-type, dry electrolysis condenser as an S-shaped compensating condenser as well as serviceability of horizontal size adjustment. Vertical deflection coils are parallel-connected for OTL output circuit operation, substantially reducing impedance.

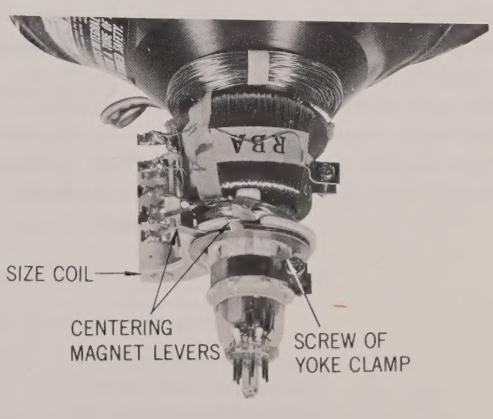

Figure 3 DEFLECTION YOKE

4. SLEEP TIMER (Only I-49)

By using the sleep timer, the TV can be automatically turned OFF at an optional time within the range of 60 minutes after turning the TV set ON.

HOW TO USE THE SLEEP TIMER

(1) Turn the set OFF by pushing the pull-on switch.
If the pull-on switch is not turned OFF, the TV set cannot be automatically turned OFF though the sleep timer operates.

(2) Set the knob of the sleep timer to your desirable time.
Any optional time can be selected within the range of 60 minutes.
However, in case of setting within 15 minutes, rotate the knob over 15 minutes in advance and rotate it counterclockwise to set to your desirable time.

(3) This condition shows that the TV set is placed under ON condition.
When the time you have set passes, the TV set will be automatically turned OFF.

(4) If turning the set OFF is desired on the way of watching TV, the set is turned OFF by rotating the sleep timer counterclockwise.

(5) If you do not want to use the sleep timer, turn the sleep timer OFF. Then, the set can be operated by turning the power switch ON or OFF.

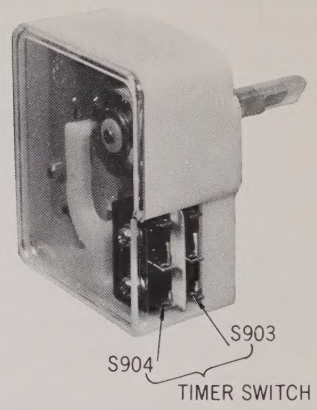

Figure 4 SLEEP TIMER

CAUTIONS ON HANDLING THE SLEEP TIMER

1. Don't give a strong shock to the sleep timer, for it is a precision machine.
2. Don't pull strongly the terminal of the timer switch.
3. In case of soldering to the terminal of the timer switch, the soldering should be done quickly within 5 seconds by using a soldering iron of 25 through 40 watts.

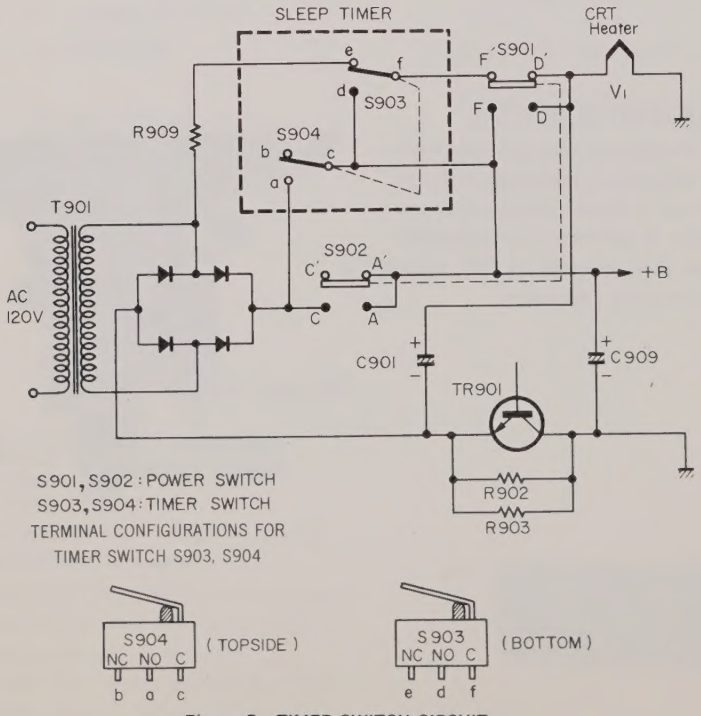

Figure 5 TIMER SWITCH CIRCUIT

DESCRIPTION OF CIRCUIT

1. ON TUNER FOR UHF AND VHF

The tuner for UHF and VHF is a single super type, its circuit construction shown in Fig. 6.

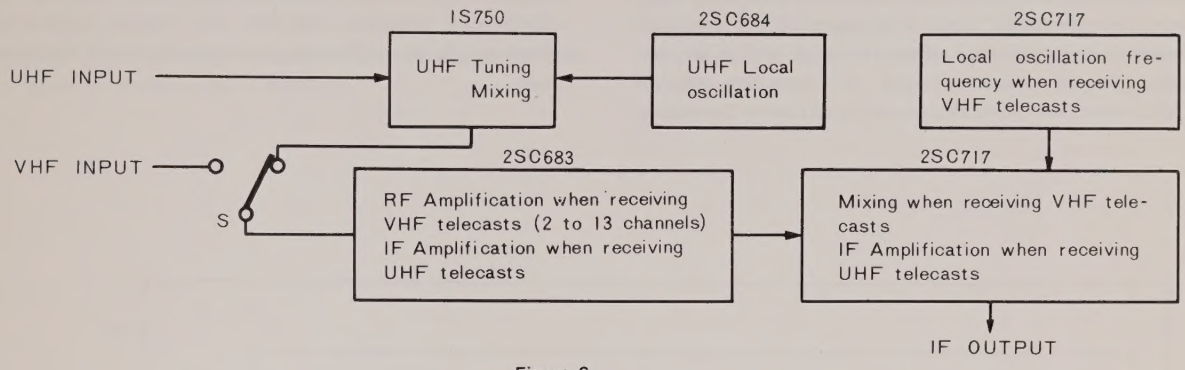

Figure 6

When receiving UHF telecasts, UHF mixing is usually a direct mixing type effected by using a diode, whose IF output is applied —through the switch S —to the video IF amplification circuit of a TV receiver.

When receiving VHF telecasts, since the UHF tuner will not function in this respect, the switch S is changed over to the input side of VHF so that the VHF signals are amplified by the VHF amplication transistor for VHF and are applied —along with the VHF local oscillation signals —to the mixing transistor, producing an video IF output.

2. VIDEO INTERMEDIATE FREQUENCY AMPLIFIER CIRCUIT

Required passing band characteristics are determined by a four-dimensional passing band filter, consisting of a π-shaped, double-tuned circuit--formed by the tuner output section and the input section of the video IF amplifier circuit--and an electrostatic coupling, double-tuned circuit set at the final stage of the video IF amplifier circuit.

Regarding carrier waves (i.e. self-voice carrier and adjacent channel carrier waves) which cannot be sufficiently attenuated through this pass band filter, a trap circuit is inserted to obtain necessary attenuation, ensuring that such waves do not occur.

Amplification of video intermediate frequency is effected by the amplifying stages comprising TR201 through TR204, where TR201 through TR203 form a flat amplifier of resistance load, while TR204 constitutes a passing band amplifier having a load of the aforementioned double-tuned circuits. The amplifying stages, consisting of TR202 and TR203, form an AGC-controlled circuit where a specific amplification degree is automatically established--according to strength of the input electric field--by the AGC voltage to be provided from the AGC circuit. This AGC-controlled circuit is designed to operate as a forward AGC circuit.

The circuit composed of TR201 operates as a fixed-gain amplifier. Since it is established at the primary stage as a fixed-bias circuit, variations of input impedance as an video IF amplifier circuit due to altering AGC voltages are appreciably decreased.

Video IF signals, amplified to a given level by the respective amplifying stages, are added to the video detector CR201, and are picked up as video signals after being detected. In this case, third higher-harmonics of the video IF signals occur due to nonlinearity of volt-ampere characteristic of the diodes, causing a disturbance in the receiving channel. Higher-harmonic preventive filter coils (L203, 204 and 205) are inserted in the detection circuit to eliminate those higher harmonics which tend to cause disturbances.

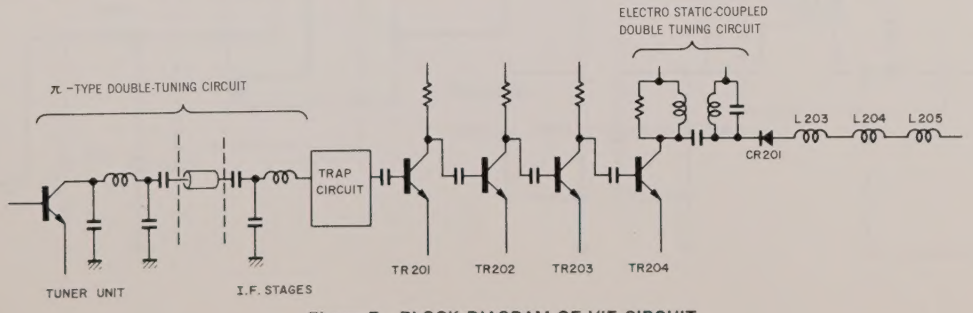

Figure 7 BLOCK DIAGRAM OF VIF CIRCUIT

3. VIDEO AMPLIFIER CIRCUIT AND SOUND IF CIRCUIT

Both the series and parallel resonance circuits, connected with the emitter and collector of the first video amplifier circuit, are tuned to 4.5 MHz. In connection with the composite video signal, they function as an emitter follower circuit, whose input impedance is high and whose output impedance is low; the signal derived from the emitter forms a low signal source impedance sufficient to drive the video output circuit as well as the synchronizing signal separator circuit. In connection with the 4.5 MHz signal, they work as a grounding circuit for the emitter, making it possible to derive a 4.5 MHz signal from the parallel tuning circuit connected with the collector.

The tuning circuit of the collector handles 4.5 MHz and exhibits a high impedance. The video amplifier circuit also works as the sound IF amplifier circuit with a high gain of amplification, imparting sufficient input signals to the limiter circuit and the sound detector circuit installed in the subsequent stage.

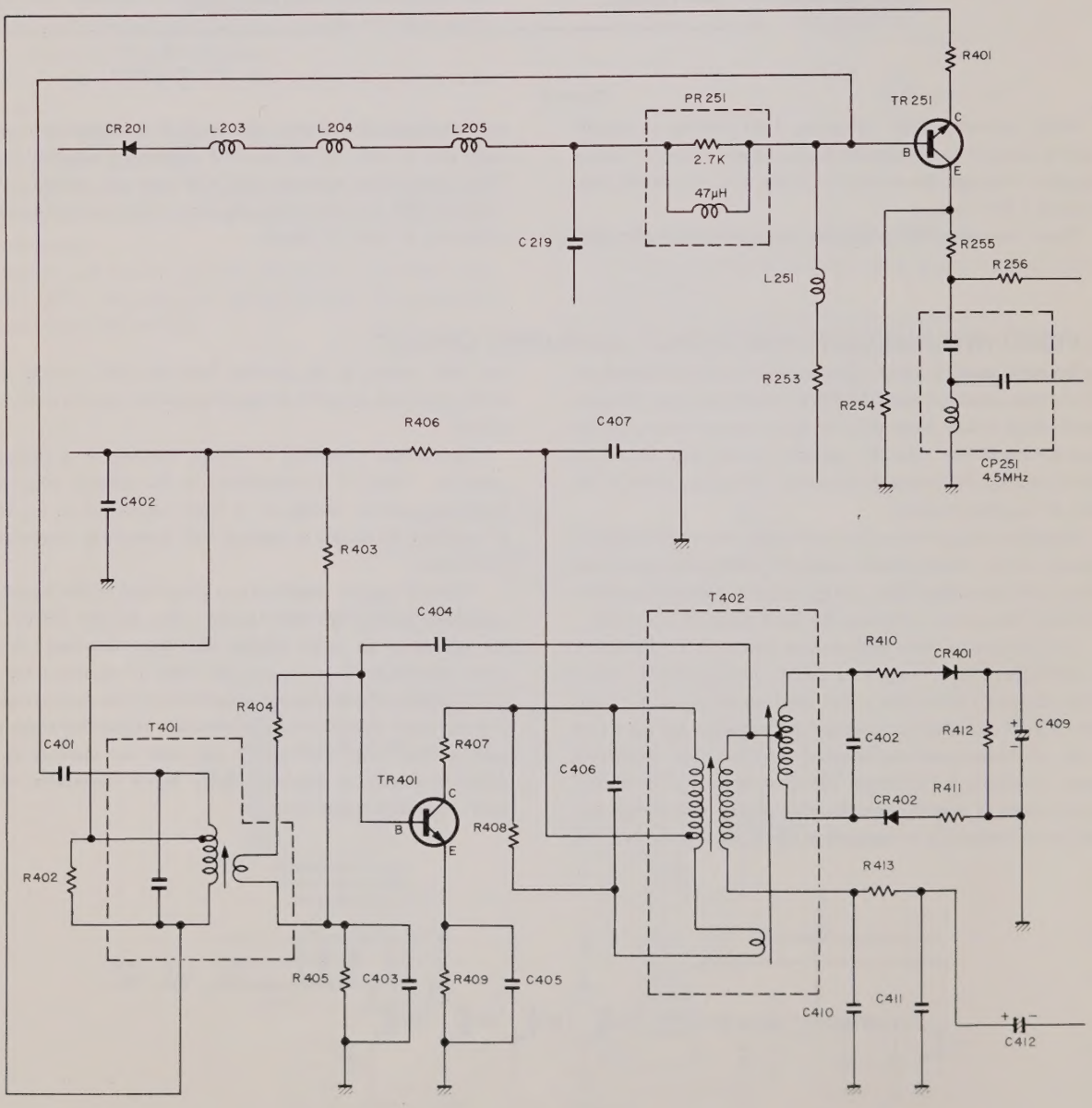

Figure 8

4. AUDIO OUTPUT CIRCUIT

A strain-free, phase-compensated symmetric SEPP. OTL circuit system is adopted for the audio output circuit. Fig. 9 shows the circuit make-up. .

Major characteristics of this circuit are:

1) Excellent frequency characteristic.
2) Minimal strain.
3) Easy in miniaturizing, since no output transformer or split-phase-inversion circuit is required.

Audio output circuit make-up

In this audio output circuit, TR402 amplifies voltage, and TR403 and TR404 push-pull amplify electric power, actuating a round speaker of 8cm diameter for 25Ω. A CR403 and R422 are inserted in the TR402 emitter to load DC/AC negative feedback for stabilized operation. Also CR403, compensating cross-over strain, is added to stabilize operation against temperature alteration.

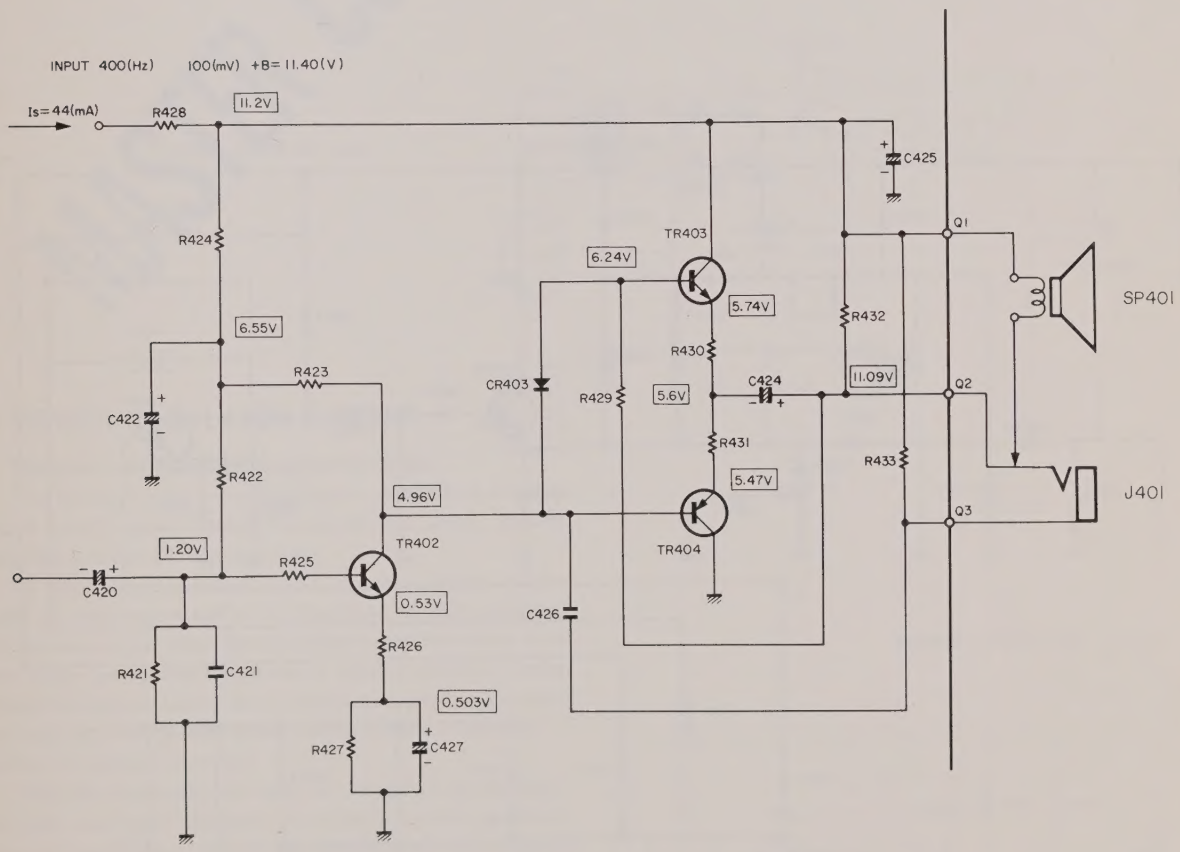

Figure 9

5. AGC CIRCUIT

This AGC circuit, a peak-value type with a noise eliminator, functions as follows :

(1) The AGC input signal is applied to the base of TR801 of the AGC detector circuit after passing through the detector circuit, first video amplifier circuit, and noise eliminator. Since the input signal passes through the noise eliminator circuit, this AGC circuit is featured by its noise-resisting characteristic.

(2) AGC detector output circuit is provided by TR801 and CR801. Since TR801 is in a saturated condition and its emitter circuit is set to a certain constant voltage, when the peak value of an input signal fed into the base of TR801 drops below a certain value, a voltage is produced in its collector. This pulse voltage is rectified by CR801 and CR805, and formed into an AGC signal.

(3) Function of the AGC amplifier circuit depends upon TR802. The AGC signal appearing across CR805 undergoes current amplification in the emitter follower circuit, producing a sufficient amount of current for controlling the VIF and the tuner.

(4) The AGC circuit distributes the AGC output delivered by the AGC amplifier circuit to the VIF and the AGC signal of the tuner. When the antenna input signal is below a certain level, the AGC of the tuner is delayed by CR803 to effect obtaining a good signal-to-noise ratio. When the antenna input signal exceeds a certain value, CR802 clamps the AGC of the VIF to obtain a good cross modulation characteristics.

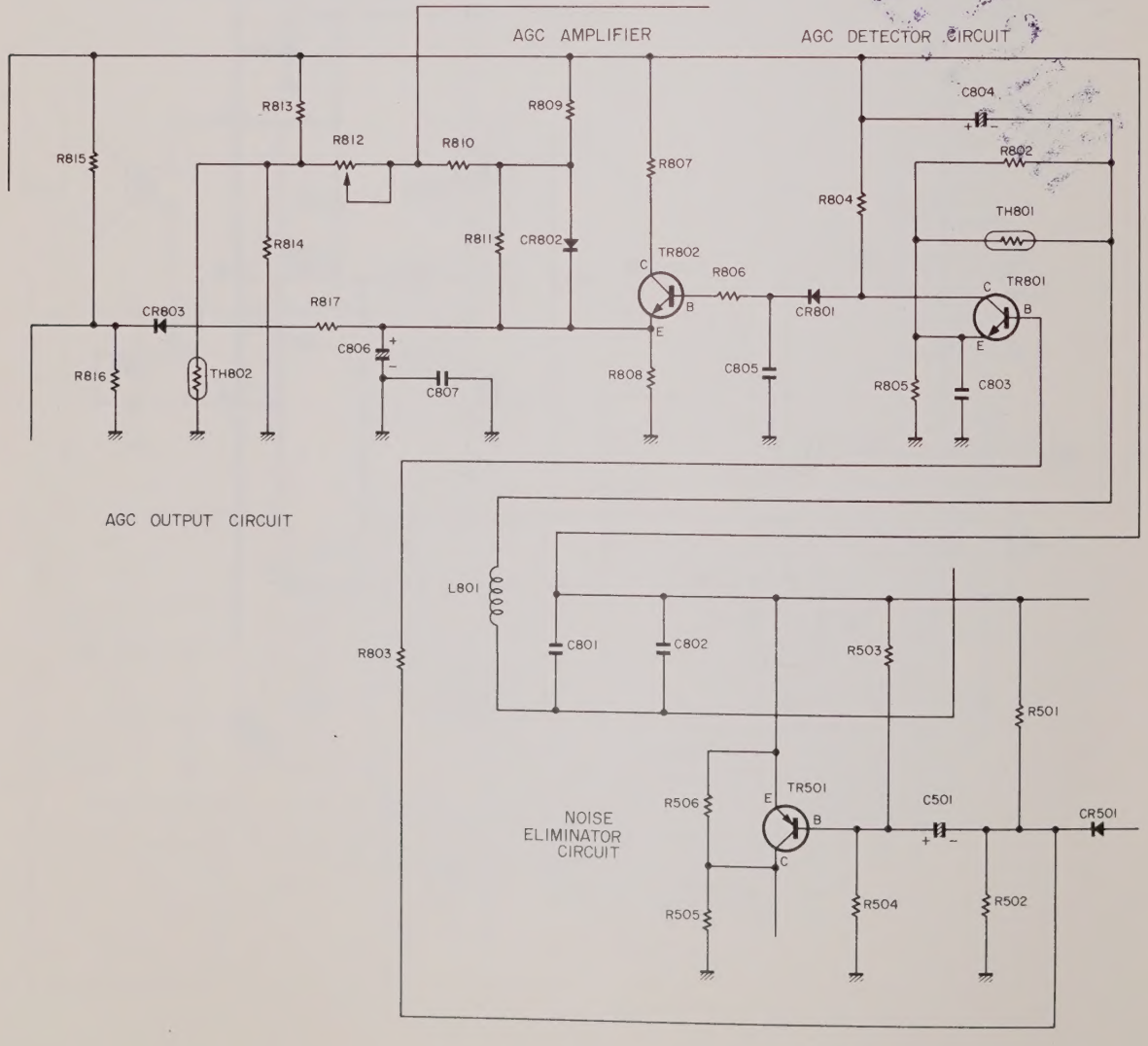

Figure 10

6. INSTANT-ACTION CIRCUIT

Except for the picture tube, all of the component parts of the Transistorized TV effect instant action therefore, if the picture tube is preheated with power 1/3 to 1/4 its rated heater power, it will start the moment the receiver is switched on.

The relationship between preheating time and starting time is shown in Fig. 11.

Fig. 12 illustrates the preheating circuit. By inserting the plug on the power source cord in a power receptacle, the heater is supplied with preheating current through R902, R903.

When receiving telecasts, by Tuning the receiver set switches S901 and S902 (interlocked) so that the rated heater power (12V, 75mA) is supplied, producing a normal picture and sound within less than one second.

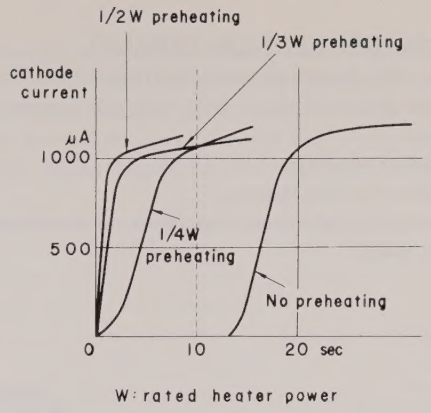

Figure 11.

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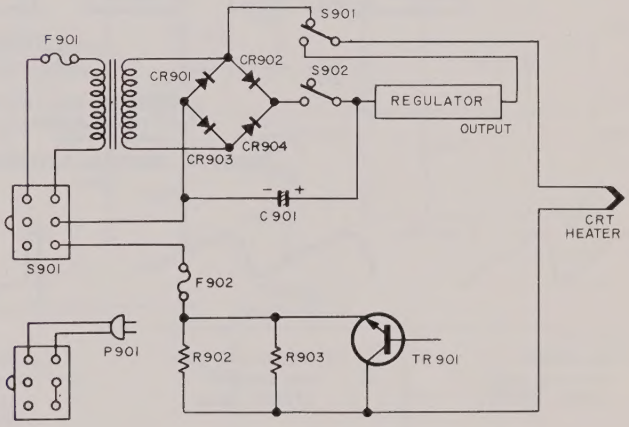


Figure 12

7. POWER REGULATOR CIRCUIT

Constant-voltage stabilizing power circuit

The constant-voltage stabilizing power circuit is so arranged that it absorbs power voltage fluctuations and always ensures obtaining constant DC output voltage.

By employing this circuit for TV circuitry, images will not break or synchronism will not be disturbed, ensuring stabilized TV operation even when power voltage fluctuation exists in an area under poor power conditions or when a temporary power voltage fluctuation occurs due to use of equipment on the same line such as a refrigerator motor (which requires substantial current at operation start-up).

This circuit not only maintains DC voltage at a given value, but also completely eliminates a pulsating current generated after AC rectification. Since it also functions as a filter circuit, it is capable of supplying perfect direct current with no pulsating current entering the TV circuit, assuring image stability.

The power regulator circuit is constructed to absorb fluctuations in power source voltage and the provide a constant DC output voltage.

This circuit is composed of a regulator part (TR901), error detector part (TR 902 and constant-voltage diode (CR905)).

Input voltage (Ein) into this circuit is combined with pulsating voltage, which has passed through the rectifier and capacitor, and is stabilized in the circuit to produce a DC 11.4V constant voltage.

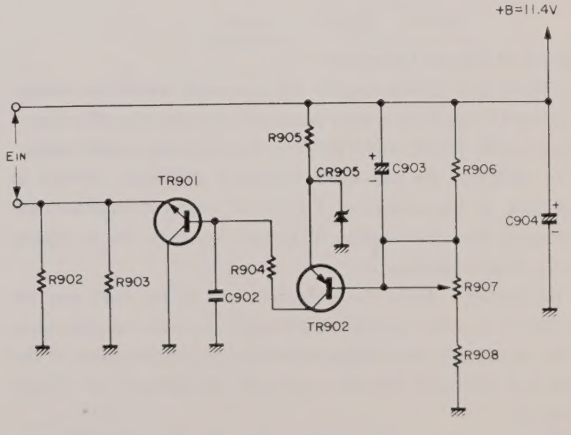


Figure 13

8. VERTICAL DEFLECTION CIRCUIT

The vertical deflection circuit effects the following functions:

(1) Provides the deflection yoke with a saw-tooth current of good linearity.
(2) Provides perfect interlacing.
(3) Provides perfect vertical blanking.
(4) Frees the vertical synchronizing signal from any disturbance due to noise signal.
(5) Provides perfect vertical deflection simultaneously with switch ON.
(6) Eliminates abnormal functions when selecting channels.

In addition to the above features, this vertical deflection circuit is a B-class p-p type which can be easily serviced since it employs neither bias adjustment nor output choke coil.

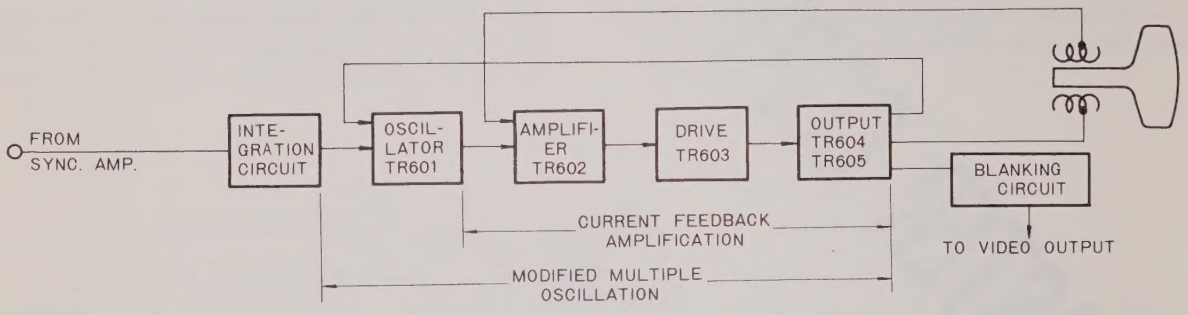


Figure 14 VERTICAL DEFLECTION CIRCUIT

(a) Waveform of oscillation output (TR601, emitter)

(b) Waveform of input into amplifier (TR602, base)

(c) Waveform of amplifier output. (at connection of R624 and R625)

(d) Waveform of blanking pulse (TR252, Emitter)

Figure 15 VOLTAGE WAVE FORM

Outline of Circuit Operation

TR602 and TR603 amplify the saw-tooth waveform voltage as shown is Fig. 15 to a level necessary for operating the output circuit, while TR604 and TR605 perform current amplification.

In addition, the saw-tooth waveform deflection current is feed back to the emitter of TR602 (AC current feedback) for preventing the deterioration of picture linearity due to ageing and for improving linearity.

Incidentally, since the deflection coil of the load may be considered a series circuit of inductance and internal resistance of the actual coil, its voltage waveform is a combination of the pulse and saw-tooth shaped component, as shown in the Figure 15 (b), (c).

The deflection coil, employing a direct-coupled Class-B p-p type amplifier, has the following merits:

(1) The picture is designed to provide increased stability of linearity which diminishes the adverse effect of ageing by using an increased number of transistors and an increased amount of loop gain.
(2) Since all of the output amplifiers are directly coupled with each other, and since DC voltage feedback is provided by R618, temperature stability at the operating point of the output circuit is improved and, at the same time, the dispersion of component parts performance is absorbed.
(3) Adoption of an output circuit of Class-B p-p type has reduced back pulse to less than power source voltage, permitting the transistors to more effectively resist breakdown.
(4) Removal of the output choke coil and the heat sink from the circuit has eased servicing the circuit.

The oscillation circuit adopts a modified multiple oscillator. As shown in Fig. 15 (a), it obtains saw-tooth waveform voltage from the emitter of TR601 by applying the positive back pulse — generated in the deflection coil during blanking time —to the base of TR601 via the feedback circuit consisting of R603, C602, C603, and R604.

The integration circuit is a double integrated type.

The blanking circuit is a newly developed clamp type which is featured by its ability to provide a sufficient blanking function despite the small back pulse transmitted from the Class-B p-p type output circuit.

When R626 is sufficiently large, the voltage waveform appearing in R626 becomes one in which the peak value of the back pulse is clamped to the emitter voltage of the video output transistor.

When an optimal R626 is employed, the equivalent clamp level is slightly raised and CR601 is biased in the forward direction during blanking time by the increased voltage.

As a result, perfect vertical blanking is accomplished by applying a blanking pulse, its size equal to that of the bias in the forward direction, (shown in Fig. 15 (d)) to the emitter of the video output transistor to effect cutting off the output transistor.

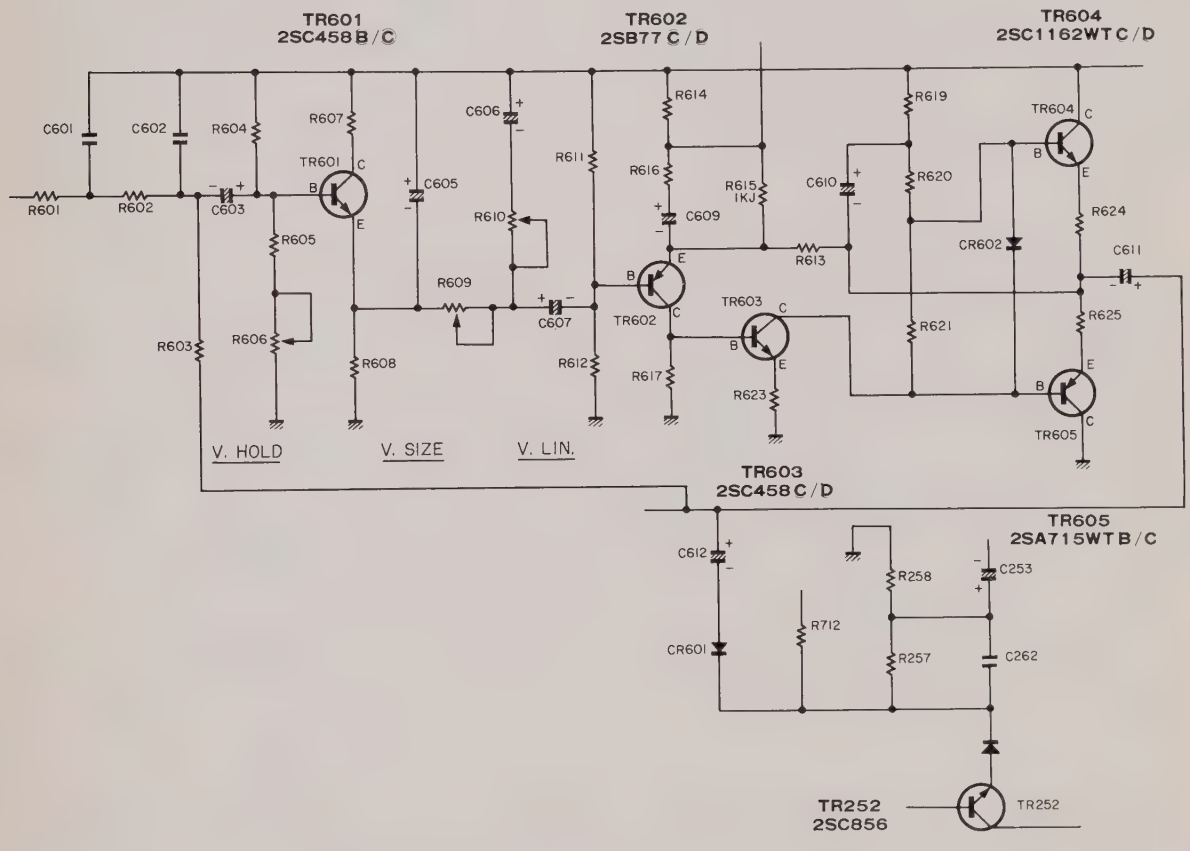


Figure 16

9. HORIZONTAL DEFLECTION CIRCUIT

AFC Circuit and Horizontal Oscillator Circuit

Adoption of the saw-tooth wave AFC circuit and the sine wave oscillator circuit has diminished a frequency drift due to variations in temperature and to ageing of components, obtaining a stabilized picture.

Compared with conventional types, the efficiency of these circuits has been improved as a result of its expanded lead-in range, accomplished by raising to −30Vp-p the AFC comparison pulse voltage supplied from the FBT.

Horizontal Drive Circuit

The reliability of the horizontal drive circuit has been improved by adopting as its TR702 a p-n-p epitaxial silicon transistor (2SA637Ⓑ/Ⓒ).

Horizontal Output Circuit

(1) Development of a direct rectification method by employing a layer-built selenium diode, whose semipermanent life is ensured for effecting high-pressure rectification, is doing a great deal to improve the fluctuation characteristic under high pressure as well as enhancing reliability of the horizontal deflection circuit.

(2) Adoption of the horizontal size adjusting coil combined with the deflection yoke has facilitated servicing of the horizontal deflection circuit.

(3) The FBT is made of Flame Retardant.

(4) Adoption of low-G2 electrodes in the picture tube has reduced the number of component parts, and overall adoption of moistureproof, glass-bonded silicon diodes has improved reliability of the horizontal deflection circuit.

(5) A boost-up circuit has been adopted which functions as follows:

The boost-up circuit, utilizing switching operation of an output transistor, charges pulse voltages (generated in the boost coil of the flyback transformer during switch-on period) between the two poles of the smoothing condenser C713 through CR704 during the period.

This circuit uses the sum of these pulse voltages and power voltages as operating voltage for the horizontal output circuit, facilitating the procurement of DC high tension as well as improving image linearity.

To be adjusted after attaching the upper plate and the bottom plate.

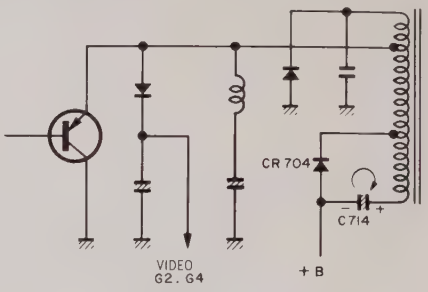


Figure 17

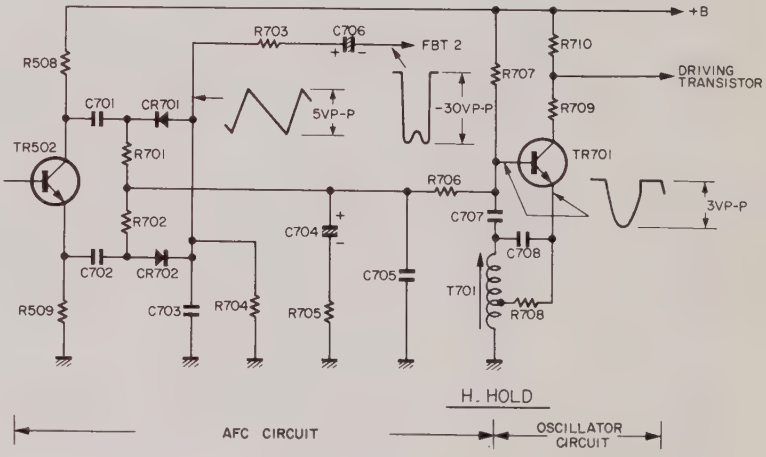


Figure 18

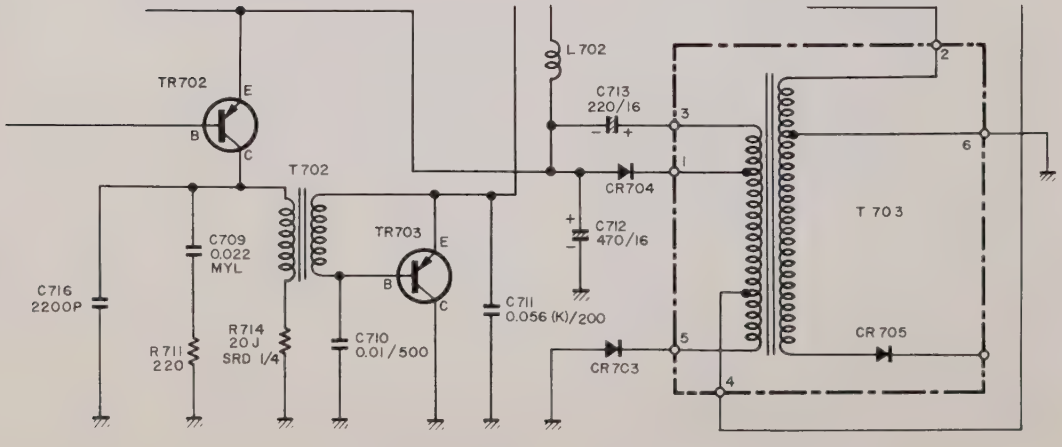


Figure 19

GENERAL ALIGNMENT INSTRUCTIONS

1. VHF TUNER

This receiver has been so designed as to operate normally without making any alignment even after a tuner is replaced.

When replacing a tuner, be sure to use a tuner whose Part No. is identical with that of the tuner to be replaced.

2. VIDEO I-F ALIGNMENT

TEST EQUIPMENT & CONNECTION

MARKER GENERATOR (35～50MHz) .....

Couple loosely to the output cable of sweep generator.

SWEEP GENERATOR (35～50MHz) .....

Connect the resistor (5.6 kΩ) and the capacitor (0.01 μF) to the test point (TP) of tuner.

OSCILLOSCOPE .....

Connect the resistor (100 kΩ) to the Emitter of TR251.

BIAS SUPPLY .....

Add 2.8～3V of AGC voltage to the terminal of R812 2kΩ-B.

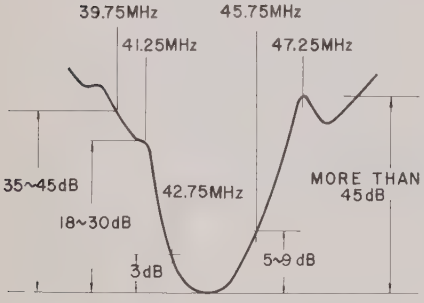


Figure 20

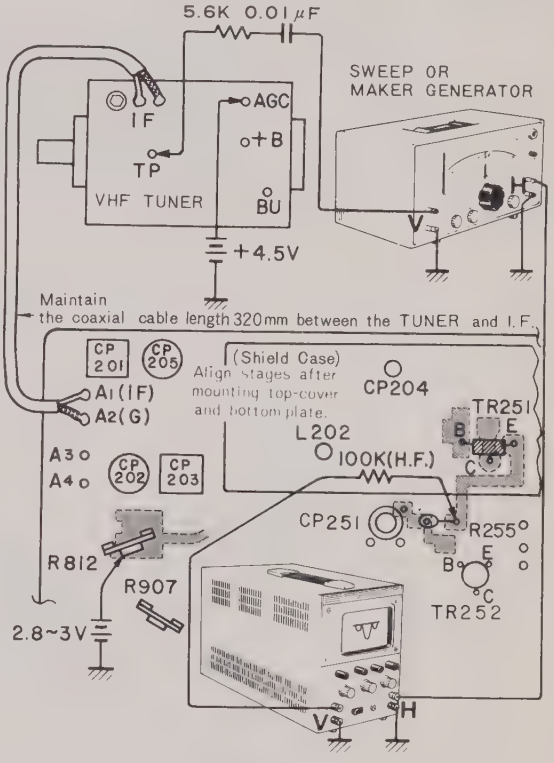


Figure 21

ALIGNMENT PROCEDURE

	STEP	SWEEP GENERATOR	MARKER GENERATOR	ADJUST	REMARKS
1	Adjust 47.25MHz Trap coil.	38～50MHz	47.25MHz 400Hz Modulation	CP202	Adjust so that the signal of 400Hz in oscilloscope may be minimum.
2	Adjust 41.25MHz Trap coil.	38～50MHz	41.25MHz 400Hz Modulation	CP203	Adjust so that the signal of 400Hz in oscilloscope may be minimum.
3	Adjust 39.75MHz Trap coil.	38～50MHz	39.75MHz 400Hz Modulation	CP205	Adjust so that the signal of 400Hz in oscilloscope may be minimum.
4	Adjust 3rd VIDEO I-F Transformer	38～50MHz	43.7MHz	CP204 L202	Adjust with CP204, L202 so that 43.7MHz may be maximum.
5	Adjust 1st VIDEO I-F Transformer	38～50MHz	44.3MHz	CP201	Adjust with CP201 so that 44.3MHz may be maximum.

If the same characteristic as that of Fig. 20 does not appear, readjust CP201, L202 and CP204 to obtain the characteristic shown in Fig. 21.

3. SOUND I-F & SOUND DEMODULATOR ALIGNMENT

TEST EQUIPMENT CONNECTION (See Figure 22)

SIGNAL GENERATOR ..... Connect capacitor (0.01 μF) to the L251.
DC VOLTMETER ..... Connect to the R412 and R413
HIGH FREQUENCY VOLTMETER ..... Connect to R256.

ALIGNMENT PROCEDURE

	STEP	DC VOLTMETER AND HIGH FREQUENCY VOLTMETER	ADJUST	REMARKS
1	Adjust discriminator primary, Sound I-F Trans.	Connect to Ⓐ (R412)	T402 (Pink) T401	Repeat adjusting primary (Pink) of T402, T401 two or three times so that the indication of DC VOLTMETER may be maximum. Adjust the output of signal generator so that maximum indication voltage may be 2V.
2	Adjust discriminator secondary	Connect to Ⓑ (R413)	T402(Blue)	Adjust T402 (Blue), for exactly one-half (approx. 1 volt) of the previous reading at Ⓐ.
3	Adjust sound take-off trans.	Connect to R256	CP251	Adjust so that the indication of HIGH FREQUENCY VOLTMETER may be minimum.
4	Repeat adjustment of STEP 1.			
5	Repeat adjustment of STEP 2.			
	When you go from STEP 1 to 2, STEP 4 to 5, don't change the output of signal generator.			

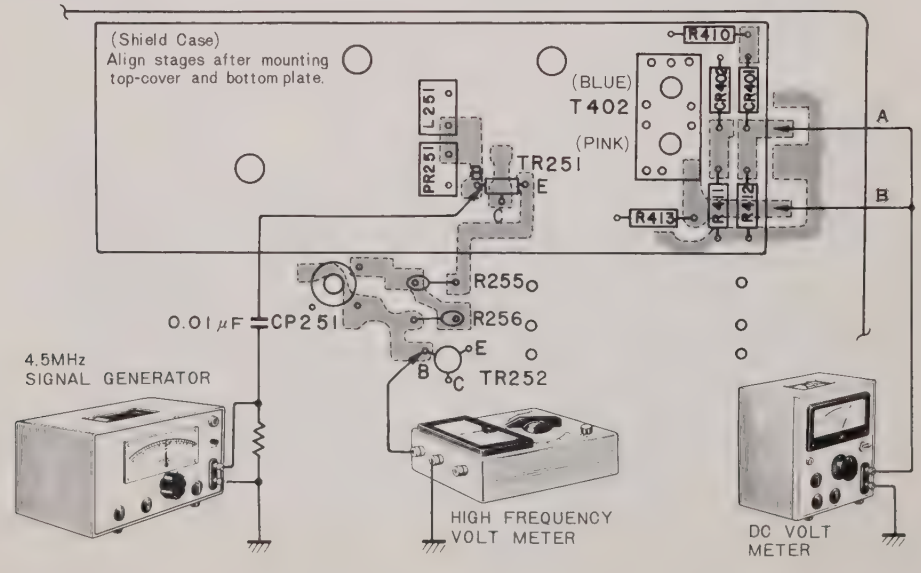


Figure 22

4. AGC ALIGNMENT

TEST EQUIPMENT CONNECTION (See Figure 23)
DC VOLTMETER ..... Connect to the terminal A3 (Tuner AGC terminal)
OSCILLOSCOPE ..... Connect to the R255.

ALIGNMENT PROCEDURE

	STEP	ADJUST	REMARKS
Connect the Test Pattern of 1 mV (electric strength) to VHF antenna terminal for the alignment of R812 2kΩ-B.			
1	Adjust the AGC Volume.	R812	Adjust R812 so that the DC VOLTMETER will indicate 3.9V ±0.1V. At the time, the voltage waveform observed by oscilloscope is to be approx. 1.1±0.15Vp-p.

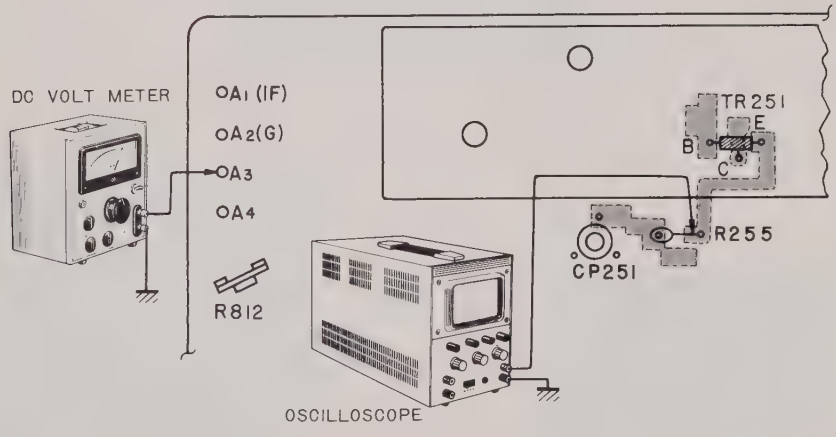


Figure 23

5. HORIZONTAL DEFLECTION ALIGNMENT

5-1 HORIZONTAL OSCILLATION CIRCUIT

ALIGNMENT PROCEDURE

	STEP	ADJUST	REMARKS
1	Horizontal oscillator adjustment	T701	Adjust T701 so that oscillation frequency may be 15.75kHz. To measure the frequency, see the frequency counter or picture drift.
2	Insert the knob so that the stopper of bobbin and the stopper receptacle of the knob will make 180° angle. See the Figure 24.		

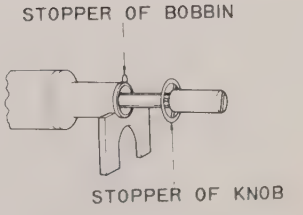


Figure 24

5-2 HORIZONTAL DEFLECTION OUTPUT CIRCUIT

Assuming a test pattern of maximum brightness and standard contrast under synchronized condition, the regulating rod is adjusted by rotating the horizontal size coil core (L703) series-connected with the deflection yoke, so that the horizontal dimension of the outside circle of the test pattern becomes 153^{+7}_{-5}mm. (Figure 25)

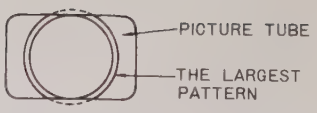


Figure 25 PATTERN SIZE

6. VERTICAL DEFLECTION ALIGNMENT

ALIGNMENT PROCEDURE

VERTICAL SIZE & LINEARITY ADJUSTMENT

Adjust R609 and R610 alternately so that the linearity may be optimum condition when the inside of the largest circle of test pattern reaches the edge of the picture tube.

After adjustment, the pulse width is confirmed to be below 880μs by observing the voltage wave at the X1 terminal. (Figure 26)

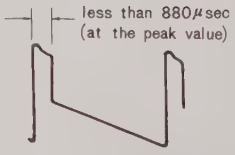


Figure 26

7. POWER SOURCE ALIGNMENT

Adjust R907 so that the voltage of P3 terminal of SS main P.W.B. may be 11.4 ±0.1V. (Leave the VOLUME CONTROL minimum, and leave BRIGHTNESS CONTROL and CONTRAST CONTROL maximum.)

8. ADJUSTING CENTERING MAGNET

Positioning H. HOLD at the center of revolution, by lowering the set power voltage until the four corners of the raster wane and by rotating the centering magnet, the centering magnet is adjusted so that the raster becomes symmetrical both left-to-right and up-and-down.

HORIZONTAL DIRECTION

When power voltage is lowered so that the raster edge appears on the CRT fluorescent screen, and when the centering magnet is revolved to set the right-hand raster end to the right end of the CRT fluorescent screen, the distance from the left-hand raster end to the left end of the CRT fluorescent screen must be within 5mm. (Figure 27)

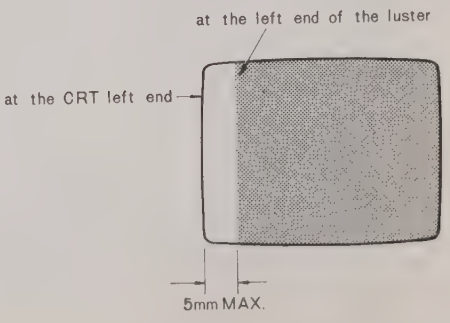


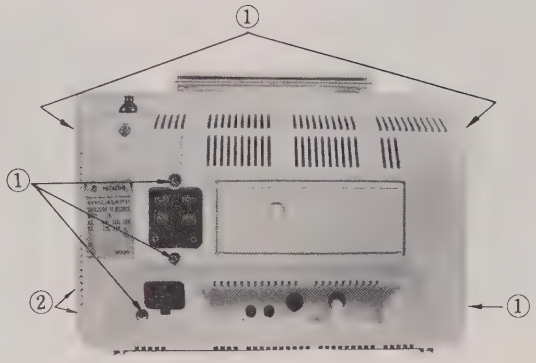
Figure 27

DISASSEMBLY INSTRUCTIONS

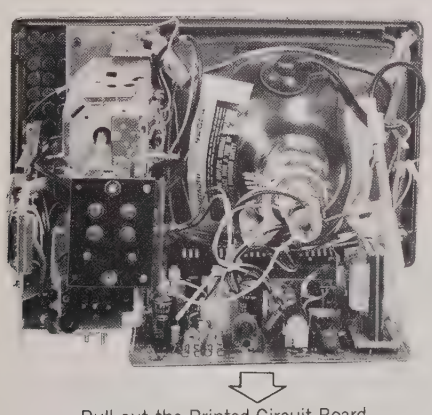
(I-29)

1. TO REMOVE BACK COVER

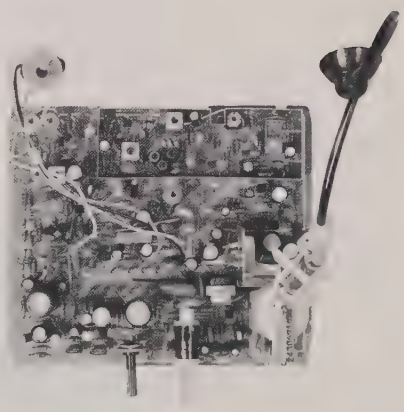
Remove screws ① and knobs ② to remove back cover.



2. INSPECTION METHOD OF PRINTED CIRCUIT BOARD

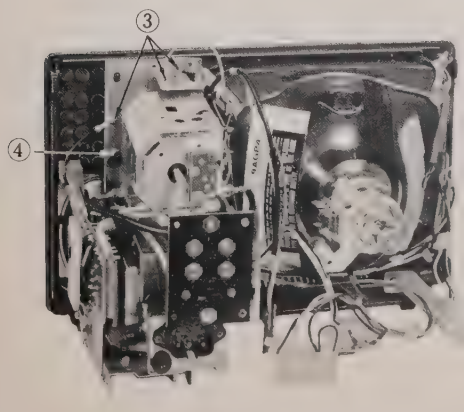


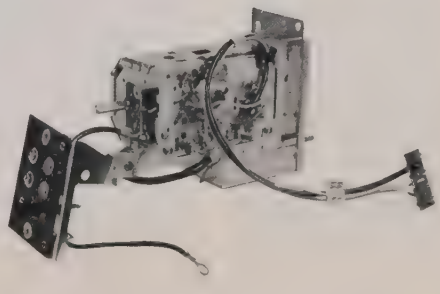
Pull out the Printed Circuit Board



3. TO REMOVE TUNER BLOCK FROM FRONT FRAME

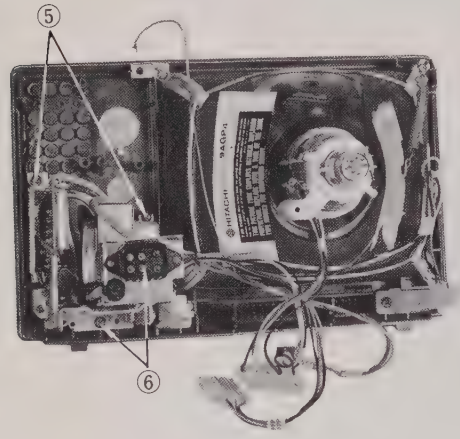
Pull out the knobs VHF and UHF channels, remove screws ③, loosen screw ④.

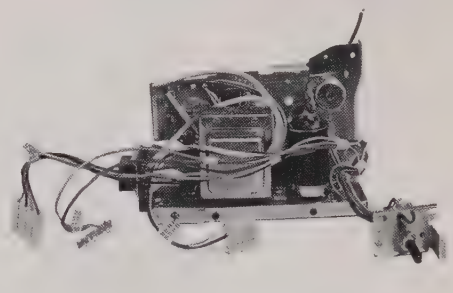




4. TO REMOVE POWER SOURCE BLOCK FROM FRONT FRAME

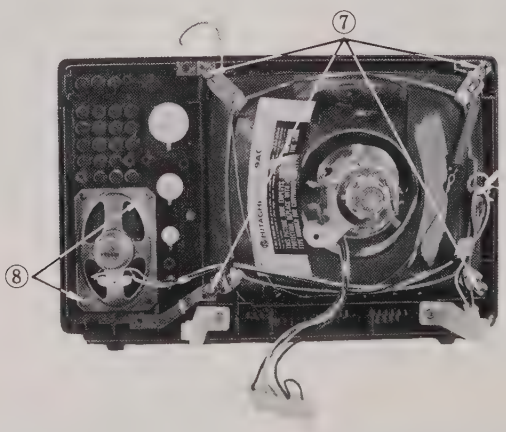
Pull out the ON-OFF & VOLUME CONTROL knob and loosen screws ⑤, remove screws ⑥.





5. TO REMOVE PICTURE TUBE AND SPEAKER FROM FRONT FRAME

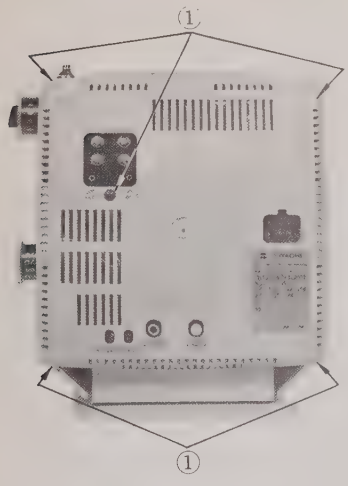
Remove screws ⑦ and ⑧.



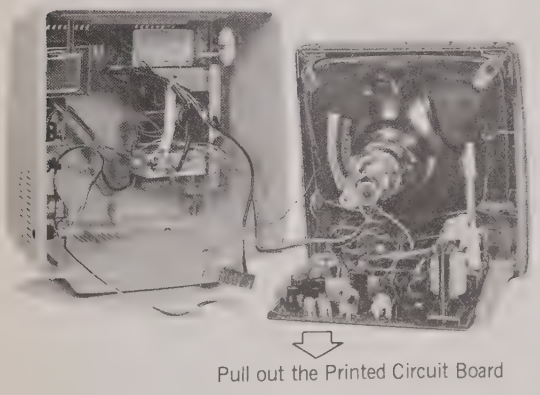
(I-49)

1. TO REMOVE BACK COVER

Remove screws ①.



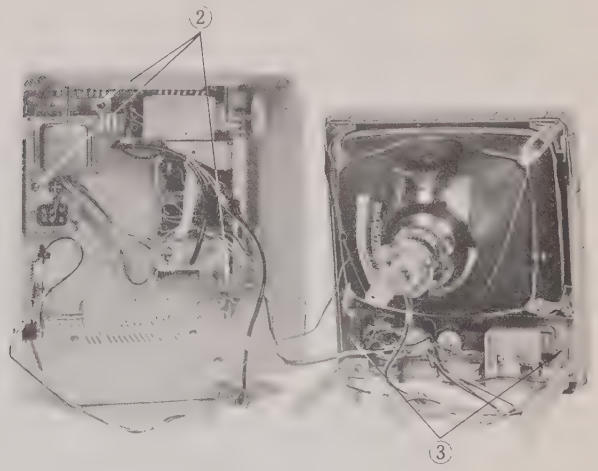
2. INSPECTION METHOD OF PRINTED CIRCUIT BOARD

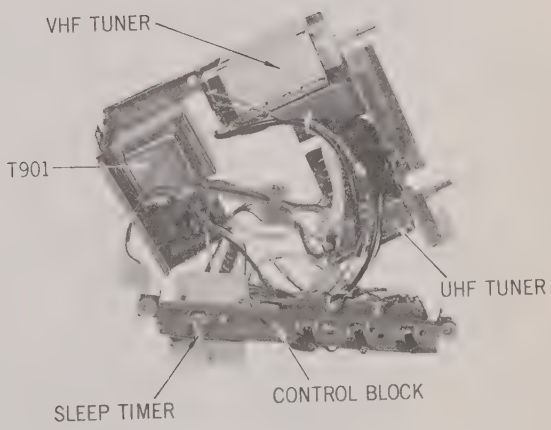


Pull out the Printed Circuit Board

3. TO REMOVE TUNER BLOCK, POWER SOURCE BLOCK AND CONTROL BLOCK

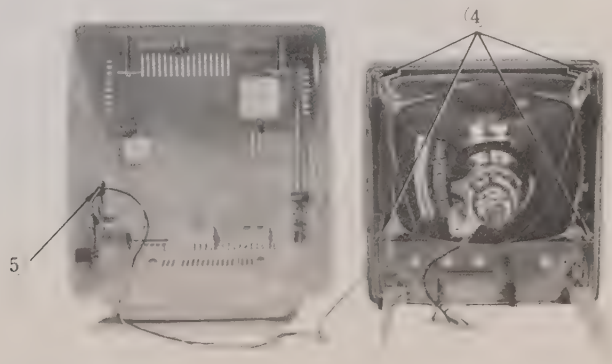
Pull out all knobs, remove screws ② and ③.



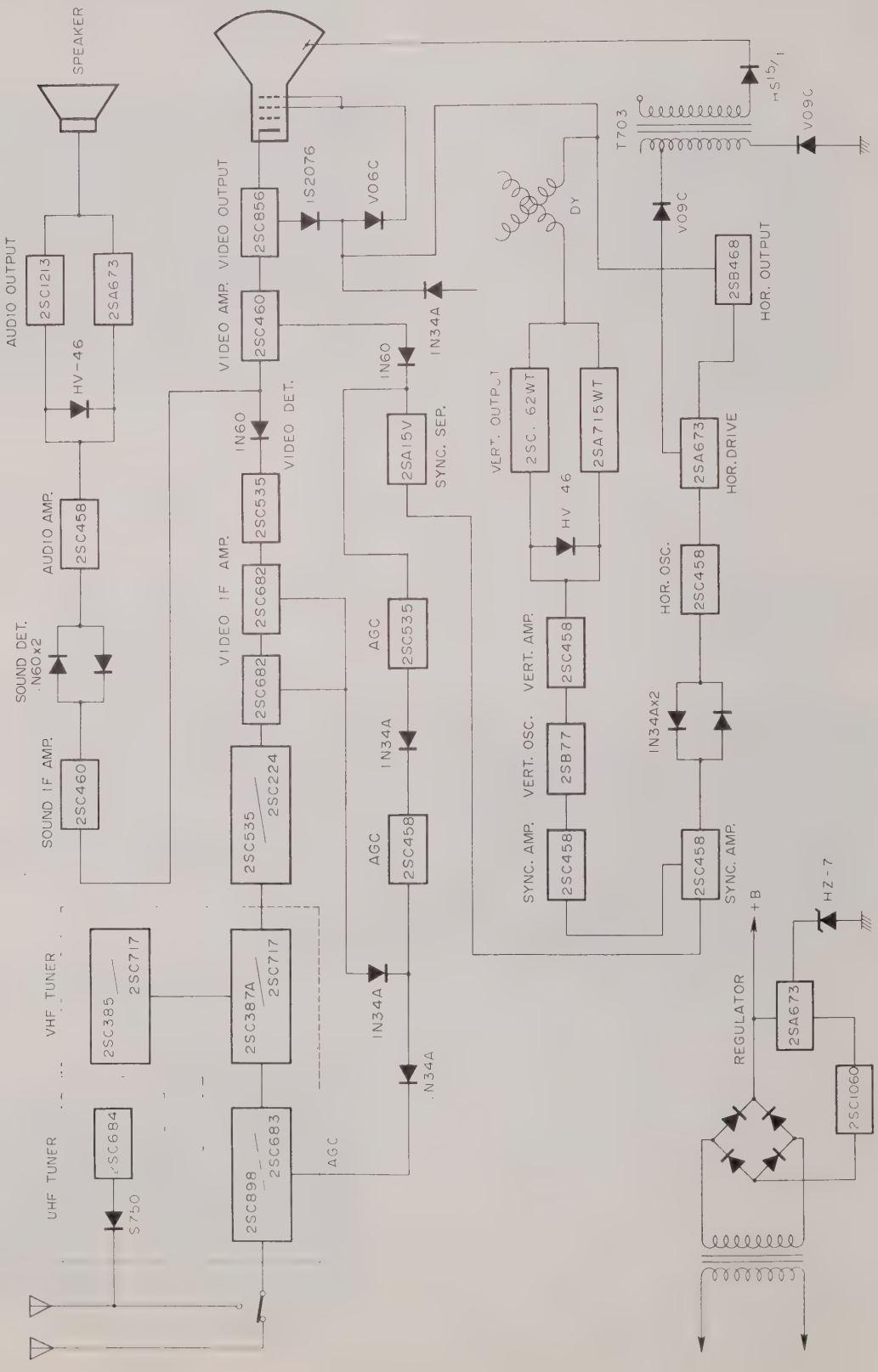


4. TO REMOVE PICTURE TUBE AND SPEAKER FROM FRONT FRAME

Remove screws ④ and ⑤.



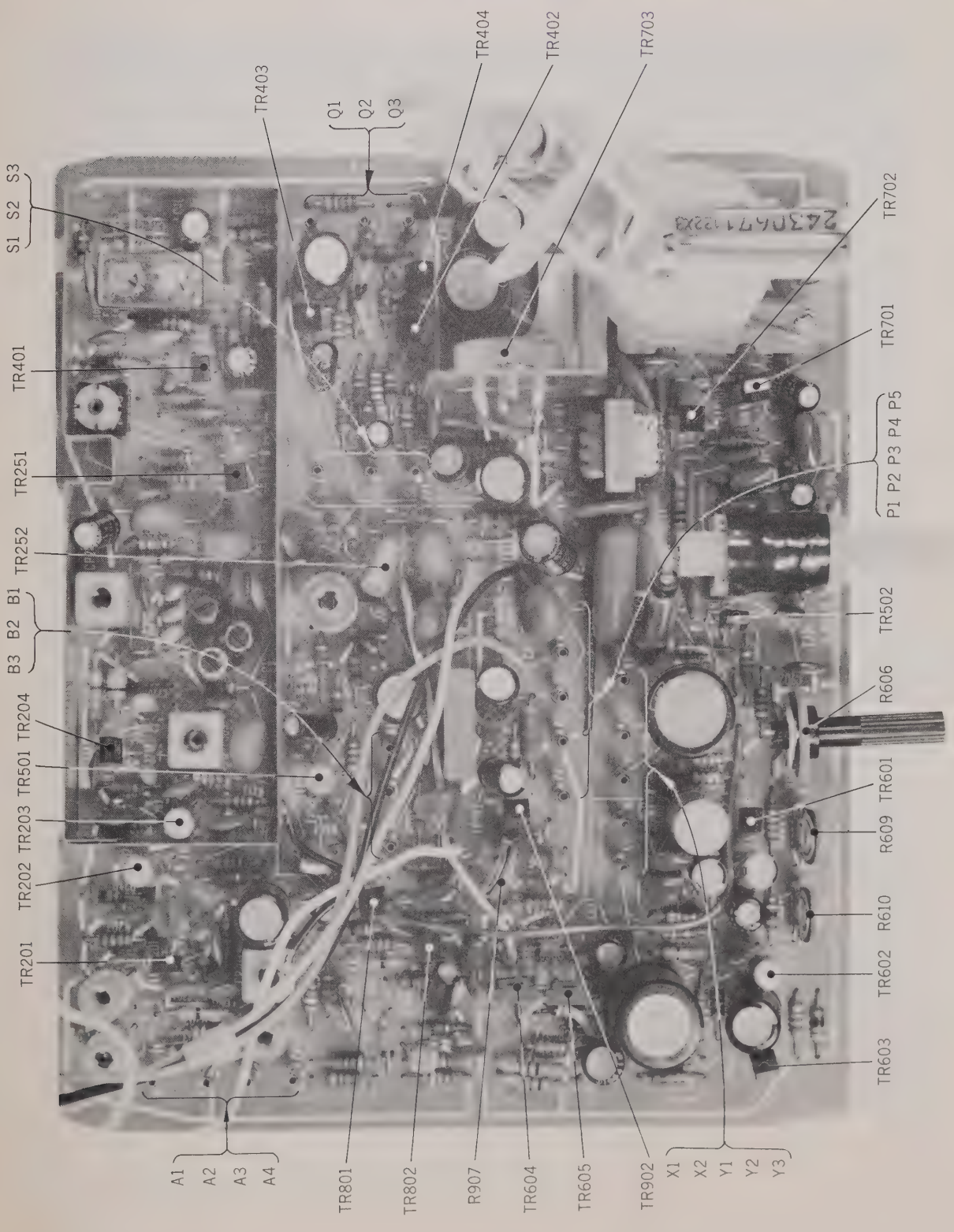
BLOCK DIAGRAM



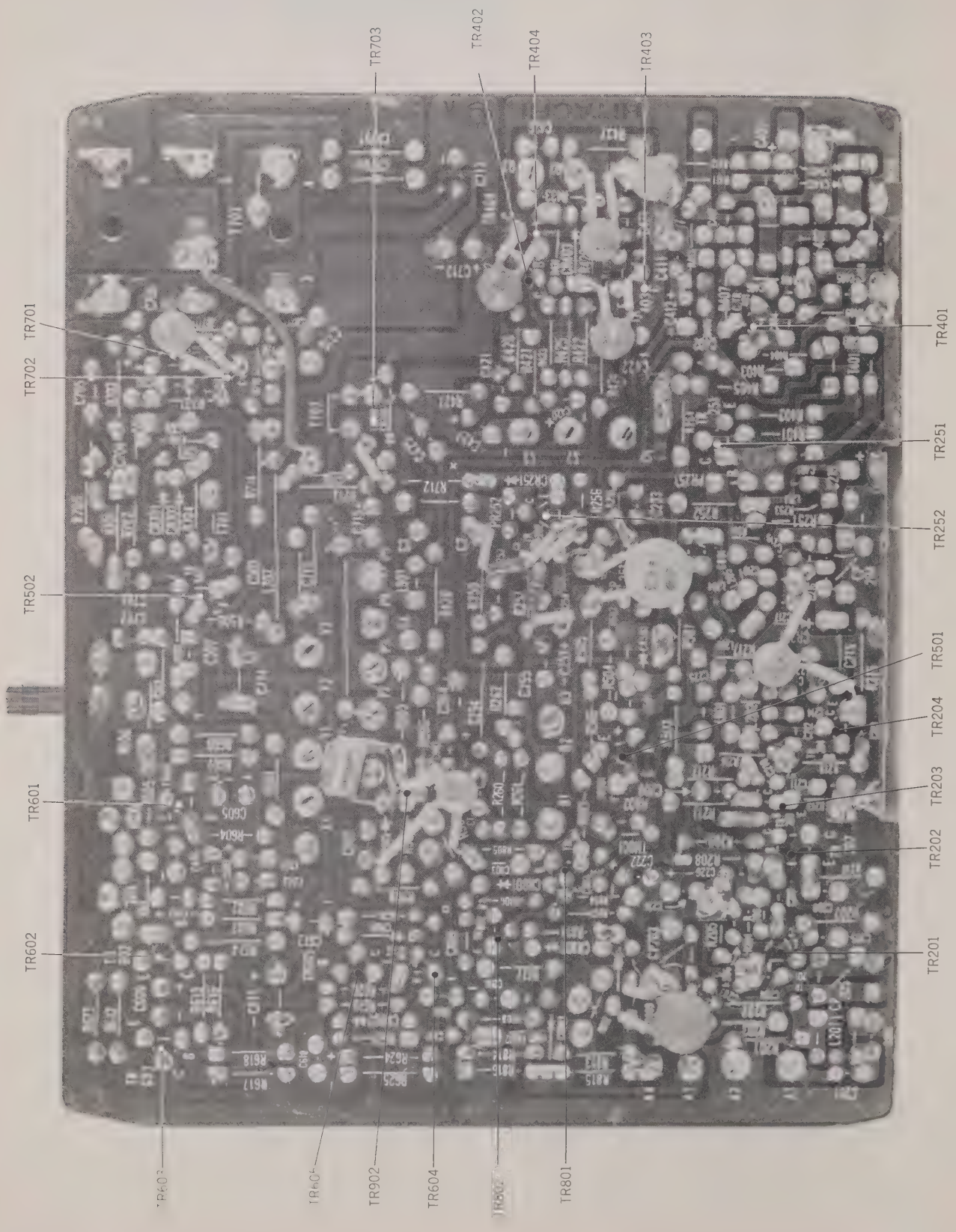
PRINTED CIRCUIT BOARD

(TOP VIEW)

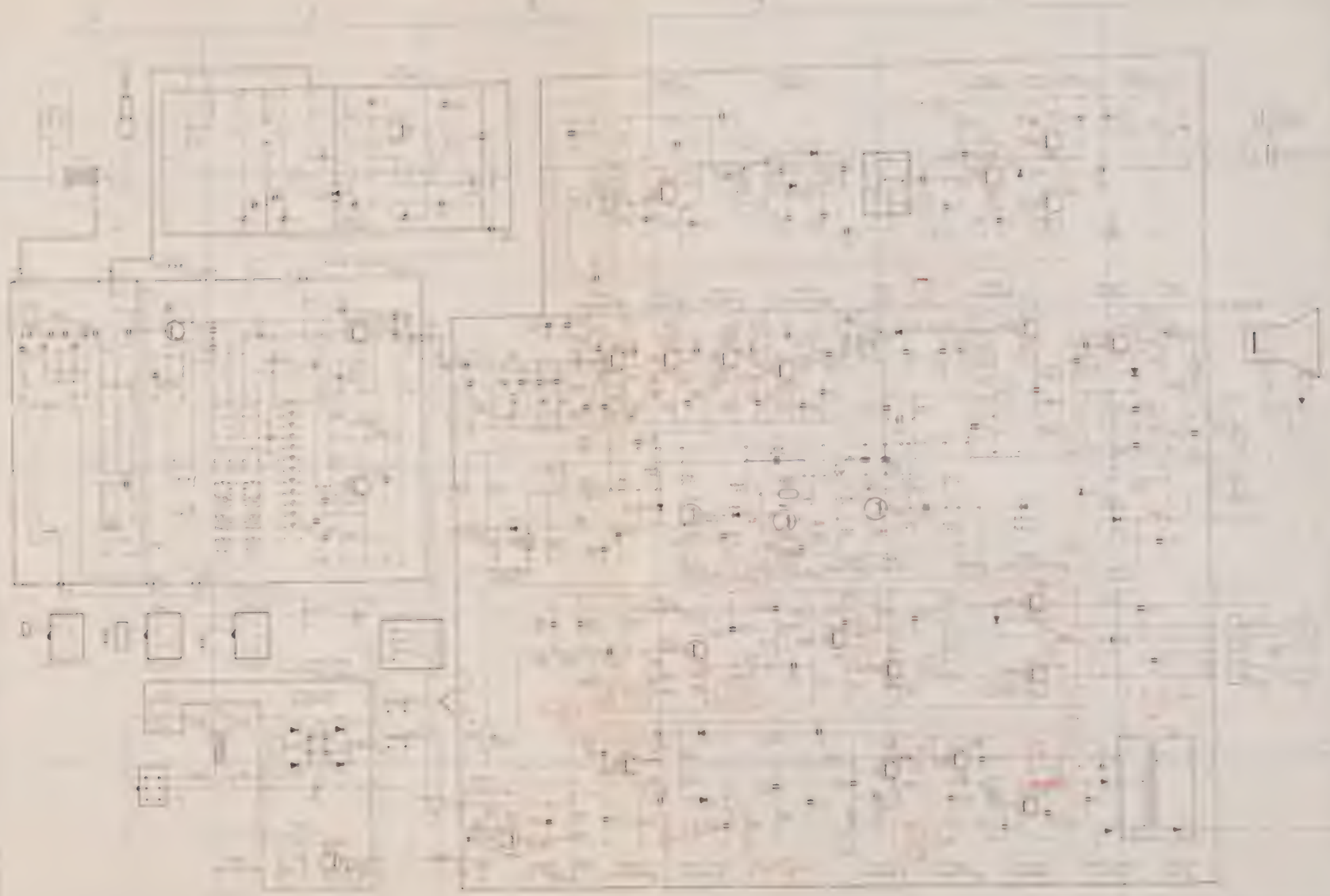
MASTER COPY



(BOTTOM VIEW)


TR703
TR402
TR404
TR403
TR701
TR702
TR401
TR251
TR252
TR502
TR501
TR204
TR601
TR203
TR202
TR602
TR201
TR902
TR604
TR801

CIRCUIT SCHEMATIC DIAGRAM (I-29, I-49)



PLACE	SYMBOL NO.	STOCK NO.	DESCRIPTION		
C 3	R 204	0131683	composition	4.7kΩ ±5%	RC¼GF
C 3	R 205	0131673	composition	1.8kΩ +5%	RC¼GF
C 3	R 206	0137561	carbon film	270Ω ±5%	RRD¼SD
C 3	R 207	0131635	composition	270Ω ±5%	RC¼GF
C 3	R 208	0131658	composition	560Ω ±10%	RC¼GF
C 4	R 209	0131635	composition	270Ω ±5%	RC¼GF
C 4	R 210	0131632	composition	200Ω ±5%	RC¼GF
C 4	R 211	0131658	composition	560Ω ±10%	RC¼GF
C 4	R 212	0131635	composition	270Ω ±5%	RC¼GF
C 4	R 213	0131632	composition	200Ω ±5%	RC¼GF
C 4	R 214	0131682	composition	4.3kΩ ±5%	RC¼GF
C 4	R 215	0131671	composition	1.5kΩ ±5%	RC¼GF
C 4	R 216	0114139	carbon film	220Ω ±5%	SRD¼P
C 4	R 217	0131612	composition	56 Ω +5%	RC¼GF
C 4	R 219	0131610	composition	39 Ω±10%	RC¼GF
C 5	R 220	0131652	composition	180Ω ±10%	RC¼GF
C 5	R 251	0131607	composition	22Ω ±10%	RC¼GF
C 5	R 252	0131641	composition	470Ω ±5%	RC¼GF
C 5	R 253	0131698	composition	3.9kΩ ±10%	RC¼GF
C 5	R 254	0131697	composition	3.3kΩ ±10%	RC¼GF
C 5	R 255	0137517	carbon film	10Ω ±5%	SRD¼SD
C 5	R 256	0137521	carbon film	15Ω ±5%	SRD¼SD
C 6	R 257	0131593	composition	82Ω ±5%	RC¼GF
D 6	R 258	0131643	composition	560Ω ±5%	RC¼GF
C 6	R 259	0134384	composition	8.2kΩ +10%	RC½GF
C 6	R 260	0131691	composition	1kΩ ±10%	RC¼GF
C 6	R 261	0131806	composition	270kΩ ±10%	RC¼GF
C 6	R 262	0131802	composition	120kΩ ±10%	RC¼GF
C 6	R 263	0159093	control	250kΩ (B)	BRIGHTNESS
D 6	R 264	0159094	control	500Ω (E)	CONTRAST
C 5	R 265	0137677	carbon film	2.7kΩ ±5%	SRD¼SD
D 6	R 266	0131727	composition	56kΩ ±5%	RC¼GF
C 6	R 263	0153668	control	250kΩ (B)	BRIGHTNESS (I−29)
D 6	R 264	0153667	control	500Ω (E)	CONTRAST (I−29)
C 5	R 401	0131653	composition	220Ω ±10%	RC¼GF
B 3	R 402	0131700	composition	5.6kΩ ±10%	RC¼GF
A 3	R 403	0131700	composition	5.6kΩ ±10%	RC¼GF
B 3	R 404	0131658	composition	560Ω ±10%	RC¼GF
B 3	R 405	0131700	composition	5.6kΩ +10%	RC¼GF
A 4	R 406	0131653	composition	220Ω ±10%	RC¼GF
B 4	R 407	0131653	composition	220Ω ±10%	RC¼GF
B 4	R 408	0131739	composition	33kΩ ±10%	RC¼GF
B 4	R 409	0131696	composition	2.7kΩ ±10%	RC¼GF
A 4	R 410	0131691	composition	1kΩ ±10%	RC¼GF
B 4	R 411	0131691	composition	1kΩ ±10%	RC¼GF
B 4	R 412	0131737	composition	2.2kΩ ±10%	RC¼GF
B 4	R 413	0131691	composition	1kΩ ±10%	RC¼GF
B 4*	R 420	0159159	control	50kΩ (A)	VOLUME (I−49)
B 5	R 420	0153681	control	50kΩ (A)	VOLUME (I−29)
B 5	R 421	0131679	composition	3.3kΩ ±5%	RC¼GF
B 5	R 422	0131713	composition	15kΩ ±5%	RC¼GF
A 5	R 423	0131733	composition	10kΩ ±10%	RC¼GF
A 5	R 424	0131702	composition	8.2kΩ ±10%	RC¼GF
B 5	R 425	0131656	composition	390Ω ±10%	RC¼GF
B 5	R 426	0131569	composition	8.2Ω ±5%	RC¼GF
B 5	R 427	0131629	composition	150Ω ±5%	RC¼GF
A 5	R 428	0114011	carbon film	5.6Ω ±5%	SRD¼P
B 5	R 429	0131693	composition	1.5kΩ ±10%	RC¼GF

PLACE	SYMBOL NO.	STOCK NO.	DESCRIPTION		
B 5	R 430	0131597	composition	3.3Ω ±10%	RC¼GF
B 5	R 431	0131597	composition	3.3Ω ±10%	RC¼GF
A 6	R 432	0131655	composition	330Ω ±10%	RC¼GF
A 6	R 433	0131649	composition	100Ω ±10%	RC¼GF
D 5	R 501	0131735	composition	15kΩ ±10%	RC¼GF
D 5	R 502	0131694	composition	1.8kΩ ±10%	RC¼GF
D 5	R 503	0131737	composition	22kΩ ±10%	RC¼GF
D 5	R 504	0131844	composition	1MΩ ±10%	RC¼GF
D 4	R 505	0131733	composition	10kΩ ±10%	RC¼GF
D 4	R 506	0131741	composition	47kΩ ±10%	RC¼GF
E 3	R 507	0131742	composition	56kΩ ±10%	RC¼GF
E 3	R 508	0131639	composition	390Ω ±5%	RC¼GF
F 3	R 509	0131641	composition	470Ω ±5%	RC¼GF
E 3	R 601	0131697	composition	3.3kΩ ±10%	RC¼GF
E 3	R 602	0131697	composition	3.3kΩ ±10%	RC¼GF
E 3	R 603	0131676	composition	2.4kΩ ±5%	RC¼GF
E 3	R 604	0131673	composition	1.8kΩ ±5%	RC¼GF
E 3	R 605	0131711	composition	12kΩ ±5%	RC¼GF
E 3*	R 606	0153716	control	50kΩ (B)	V. HOLD
E 4	R 607	0131602	composition	8.2Ω ±19%	RC¼GF
E 4	R 608	0131711	composition	12kΩ ±5%	RC¼GF
E 4	R 609	0151245	control	5kΩ (B)	V. SIZE
E 4	R 610	0151245	control	5kΩ (B)	V. LIN.
E 4	R 611	0131709	composition	10kΩ ±5%	RC¼GF
E 4	R 612	0131738	composition	27kΩ ±10%	RC¼GF
D 4*	R 614	0111504	metal film	0.5Ω ±5%	RN¼
E 4	R 615	0131667	composition	1kΩ ±5%	RC¼GF
E 4	R 616	0131597	composition	3.3Ω ±10%	RC¼GF
E 4	R 617	0131671	composition	1.5kΩ ±5%	RC¼GF
E 5	R 618	0131667	composition	1kΩ ±5%	RC¼GF
E 5	R 619	0131631	composition	180Ω ±5%	RC¼GF
E 5	R 620	0131631	composition	180Ω ±5%	RC¼GF
E 5	R 621	0131637	composition	330Ω ±5%	RC¼GF
E 5	R 623	0131583	composition	33Ω ±5%	RC¼GF
E 5	R 624	0119502	metal film	1Ω ±5%	RN¼
E 5	R 625	0119502	metal film	1Ω ±5%	RN¼
E 6	R 626	0131631	composition	180Ω ±5%	RC¼GF
F 4	R 701	0131685	composition	5.6kΩ ±5%	RC¼GF
F 4	R 702	0131685	composition	5.6kΩ ±5%	RC¼GF
E 4	R 703	0134063	composition	820Ω ±5%	RC½GF
F 4	R 704	0131677	composition	2.7kΩ ±5%	RC¼GF
F 4	R 705	0131659	composition	680Ω ±10%	RC¼GF
F 4	R 706	0131683	composition	4.7kΩ ±5%	RC¼GF
E 5*	R 707	0131718	composition	24kΩ ±5%	RC¼GF
F 4	R 708	0131581	composition	27Ω ±5%	RC¼GF
F 5	R 709	0131633	composition	220Ω ±5%	RC¼GF
E 5	R 710	0131643	composition	560Ω ±5%	RC¼GF
F 5	R 711	0131653	composition	220Ω ±10%	RC¼GF
C 5	R 712	0134121	composition	10kΩ ±5%	RC¼GF
D 6	R 713	0114281	carbon film	100kΩ ±5%	SRD¼P
F 5	R 714	0114048	carbon film	20Ω ±5%	SRD¼P
C 5	R 801	0131632	composition	200Ω ±5%	RC¼GF
D 4	R 802	0131632	composition	200Ω ±5%	RC¼GF
D 4	R 803	0131695	composition	2.2kΩ ±10%	RC¼GF
D 4	R 804	0131695	composition	2.2kΩ ±10%	RC¼GF

PLACE	SYMBOL NO.	STOCK NO.	DESCRIPTION		
D 4	R 805	0131629	composition.	150Ω ±5%	RC¼GF
D 4	R 806	0131653	composition.	220Ω ±10%	RC¼GF
D 4	R 807	0131649	composition.	100Ω ±10%	RC¼GF
D 4	R 808	0131691	composition.	1kΩ ±10%	RC¼GF
D 3	R 809	0131698	composition.	3.9kΩ ±10%	RC¼GF
D 3	R 810	0131654	composition.	270Ω ±10%	RC¼GF
D 3	R 811	0131700	composition.	5.6kΩ ±10%	RC¼GF
D 3	R 812	0151246	control	2kΩ (B)	AGC
D 3	R 813	0131696	composition.	2.7kΩ ±10%	RC¼GF
D 3	R 814	0131658	composition.	560Ω ±10%	RC¼GF
D 3	R 815	0131689	composition.	8.2kΩ ±5%	RC¼GF
D 3	R 816	0131681	composition.	3.9kΩ ±5%	RC¼GF
D 3	R 817	0131649	composition.	100Ω ±10%	RC¼GF
E 1	R 901	0134428	composition.	2.2MΩ ±10%	RC½GF
F 2	R 902	0134053	composition.	330Ω ±5%	RC½GF
F 2	R 903	0134053	composition.	330Ω ±5%	RC½GF
F 3	R 904	0131654	composition.	270Ω ±10%	RC¼GF
F 3	R 905	0134043	composition.	120Ω ±5%	RC½GF
F 3	R 906	0131667	composition.	1kΩ ±5%	RC¼GF
F 3	R 907	0151249	control	1kΩ (B)	+ B ADJ
F 3	R 908	0131647	composition.	820Ω ±5%	RC¼GF
F 3	R 909	0134022	composition.	18Ω ±5%	RC½GF

TRANSISTORS

C 3	TR201	2320471	2SC535 Ⓑ / Ⓒ
D 3	TR202	0573474	2SC682 Ⓐ
D 3	TR203	0573474	2SC682 Ⓐ
D 3	TR204	2320471	2SC535 Ⓑ / Ⓒ
C 5	TR251	2320041	2SC460 Ⓑ
C 6	TR252	2320051	2SC856
B 4	TR401	2320041	2SC460 Ⓑ
B 5	TR402	0573481	2SC458 Ⓒ
A 5	TR403	2320643	2SC1213 Ⓒ
B 5	TR404	2320632	2SA673 Ⓒ
D 4	TR501	0573422	2SA15 V
F 3	TR502	2320591	2SC458 Ⓑ / Ⓒ
E 4	TR601	2320591	2SC458 Ⓑ / Ⓒ
E 4	TR602	2320423	2SB77 Ⓒ / Ⓓ
E 5	TR603	2320596	2SC458 Ⓒ / Ⓓ
E 5*	TR604	2320845	2SC162WT Ⓒ / Ⓓ
E 5*	TR605	2320855	2SA715WT Ⓑ / Ⓒ
F 4	TR701	0573480	2SC458 Ⓑ
F 5	TR702	2320631	2SA673 Ⓑ / Ⓒ
F 5	TR703	0573212	2SB468
D 4	TR801	2320471	2SC535 Ⓑ / Ⓒ
D 4	TR802	0573480	2SC458 Ⓑ
F 2	TR901	2320482	2SC1060 Ⓑ
F 3	TR902	2320632	2SA673 Ⓒ

DIODES

C 5	CR201	0575005	1N60
C 6	CR251	2330351	1S2076
A 4	CR401	0575005	1N60
B 4	CR402	0575005	1N60
B 5	CR403	2330611	HV−46
D 5	CR501	0575005	1N60
D 5	CR601	0575001	1N34A
E 5	CR602	2330611	HV−46
E 4	CR701	0575001	1N34A
F 4	CR702	0575001	1N34A
F 5	CR703	2330551	VO9C
F 5	CR704	2330551	VO9C
F 6	CR705	2330032	HS15/1
D 6	CR706	2330251	VO6C
D 4	CR801	0575001	1N34A
D 3	CR802	0575001	1N34A
D 3	CR803	0575001	1N34A
E 2	CR901	2330251	VO6C
E 2	CR902	2330251	VO6C
F 2	CR903	2330251	VO6C
F 2	CR904	2330251	VO6C
F 3*	CR905	2330791	zener HZ−7 Ⓐ / Ⓑ
D 4	TH801	0576057	thermistor D−1E
D 3	TH802	0576038	thermistor D−2B

TRANSFORMERS

A 1	T001	0511368	balun	
B 3	T401	2140961	I.F.	
B 4	T402	0326022	I.F.	
F 4	T701	2160232	horizontal oscillator	
F 5	T702	0390018	horizontal drive	
F 6*	T703	2430751	flyback	
E 1*	T901	2210547	power	(I−29)
E 1	T901	2210571	power	(I−49)

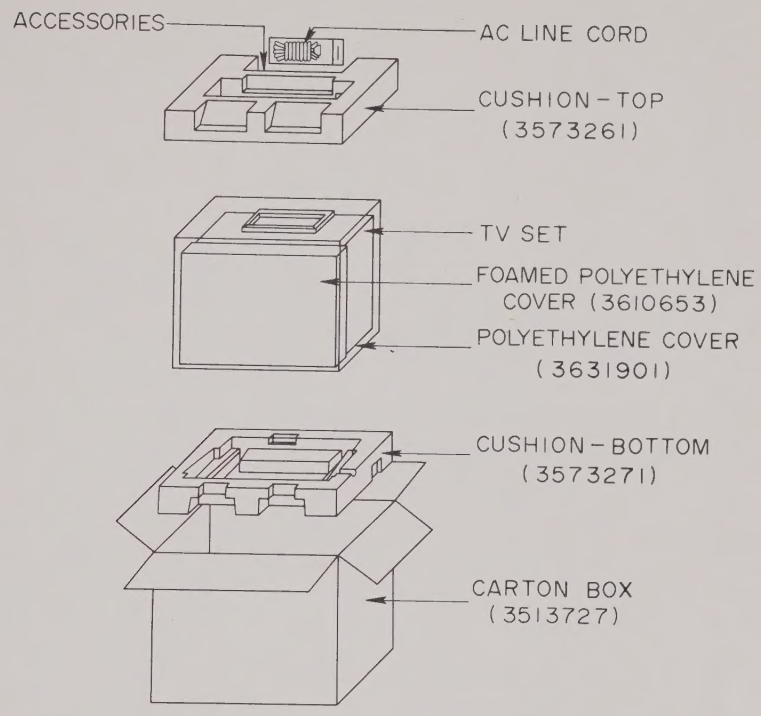
COILS

C 4	L202	2140645	I.F.	
C 5	L203	2120467	trap	
C 5	L204	2120468	filter	
C 5	L205	2120466	trap	
C 3	L206	2120239	peaking	
C 5	L251	2120263	peaking	470μH
C 6	L252	2120265	peaking	560μH
C 5	PR251	2121132	peaking	47μH / 1.2kΩ
C 6	PR252	2120666	peaking	390μH / 15kΩ
E 5	L702	2120041	horizontal oscillator	
D 4	L801	2120247	peaking	120μH
D 5	L901	2120245	peaking	100μH

PLACE	SYMBOL NO.	STOCK NO.	DESCRIPTION
E 2	L 902	2120331	filter
F 3	L 903	2120331	filter
E 2	L 904	0319033	filter
C 3	CP201	2790071	compound component
C 3	CP202	2790072	compound component
C 3	CP203	2790073	compound component
C 4	CP204	2790075	compound component
C 3	CP205	2790075	compound component
C 5	CP251	2790045	compound component
E 2	CP901	2790083	compound component
E 2	CP902	2790083	compound component
		2750092	Antenna —Telescopic antenna (I—49)
		2750091	Antenna —Telescopic antenna (I—29)
		2750051	Antenna —Loop
*		2683651	Board —Antenna terminal board (I—49)
		2682461	Board —Antenna terminal board (I—29)
*		2515441	Board—Printed circuit board assembly
*		3154006	Cover—Back (ivory) (I—49)
*		3154007	Cover—Back (yellow) (I—49)
*		3154102	Cover—Back (I—29)
*		2740703	Cord—AC line cord and plug
		2730013	Earphone—Magnetic earphone
*		3213131	Frame—Cabinet front frame assembly (I—49)
*		3213132	Frame—Cabinet front frame assembly (I—49)
		3213181	Frame—Cabinet front frame assembly (I—29)
	F901	2720052	Fuse —0.75A
	F902	0591207	Fuse—1.6A
*		3190351	Filter—Black filter (I—49)
C 6	SG251	2340032	Gap—Spark gap
		3722425	Handle—Carrying handle (I—29)
		4770871	Handle —Carrying handle (I—49)
B 6	J401	2670313	Jack—Earphone jack (I—29)
B 6*	J401	2670531	Jack—Earphone jack (I—49)
*		3254151	Knob—VHF channel selector knob assembly (I—49)
*		3254021	Knob—VHF channel selector knob assembly (I—29)
*		3254161	Knob—UHF outer knob (I—49)
*		3254181	Knob—UHF indicator (I—49)
		3253772	Knob—UHF indicator (I—29)
		3253791	Knob—UHF channel selector assembly (I—29)
*		3253421	Knob—Pre-set fine tuning knob (I—49)
*		3254041	Knob—Pre-set fine tuning knob (I—29)
*		3254201	Knob—Sleep timer knob (I—49)
*		3254191	Knob—Contrast (I—49)
*		3254191	Knob—Brightness (I—49)
		3252327	Knob—Contrast assembly (I—29)
		3252327	Knob—Brightness assembly (I—29)
		3254361	Knob—Pull-on volume (I—49)
		3250521	Knob—Pull-on volume (I—29)
*		4791863	Ring—Contrast knob (I—29)
*		4781091	Ring —VHF tuner knob (I—29)
A 6*	SP401	2410382	Speakr—9×6cm PM speaker 25 ohms (I—29)
A 6	SP401	2410481	SPeaker—8×8cm PM speaker 25 ohms (I—49)
C 6	V 1	2350224	Tube—Picture tube 9AGP4
*		2421251	Tuner—VHF tuner assembly HT—401 (I—49)
		2420155	Tuner—UHF tuner assembly HU—407C (I—49)
		2420616	Tuner—VHF tuner (I—29)
E 6*	DY	2240454	Yoke—Defrection yoke

HOW TO PACK

(I-29)



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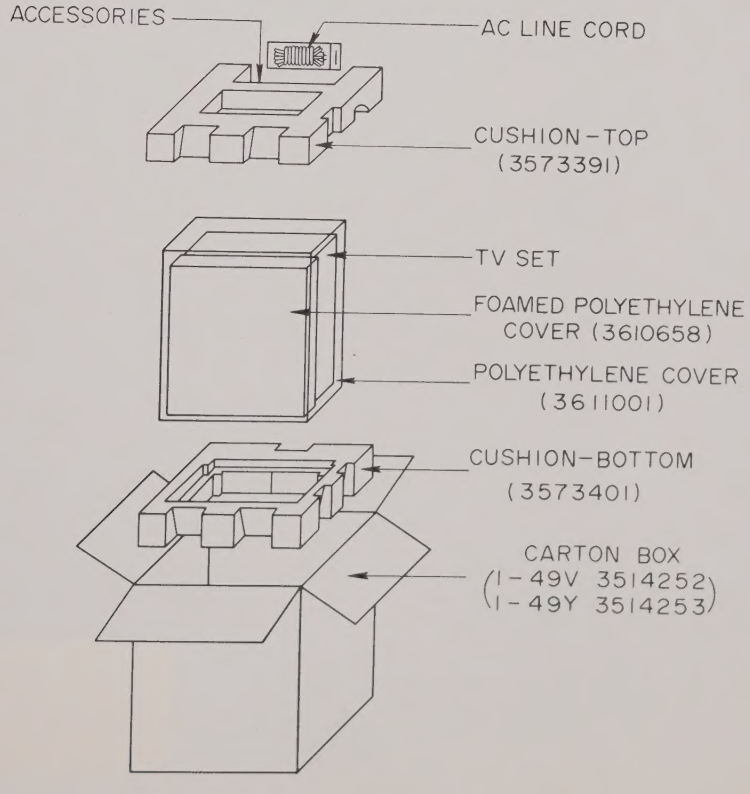

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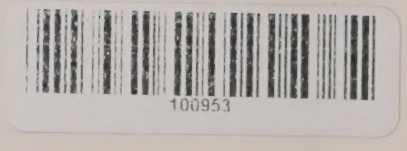

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